

Whole-farm Phosphorus Management on Dairy Farms

Introduction

The US dairy industry is undergoing rapid change to remain economically viable. Many farms are expanding herd size and increasing the importation of feed. Recently approved nutrient management regulations for concentrated animal feeding operations (CAFOs) aim to reduce environmental pollution by controlling manure management.

Government policy and P management

In the US, the land application of manure is becoming increasingly regulated based on a combination of soil test P, crop P requirements, manure P content, and a field's risk to lose P to surface water.

- According to current regulations, fields having excessive levels of soil test P should not receive manure.

Legislative controls on manure use that have been adopted in Europe include:

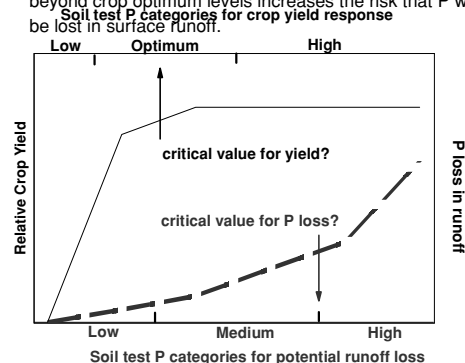
- limiting the number of cows a farm can keep based on the cropland area available for manure application, and/or
- putting an outright limit on the amount of manure P that can be land applied.

Agricultural P and the environment

The control of P inputs is of prime importance in reducing P runoff losses and environmental pollution. Some dairy farms consistently accumulate P because imports of P onto the farm (feed and fertilizer) exceed exports (milk).

In many areas of intensive livestock production, the amount of manure P often exceeds crop P requirements. This can lead to a disposal rather than an agronomic use of manure, with a subsequent build-up of soil test P levels, much above what is needed for optimal crop yields.

The relationship between soil test P and crop yield has been well established. However, the buildup of soil test P beyond crop optimum levels increases the risk that P will be lost in surface runoff.



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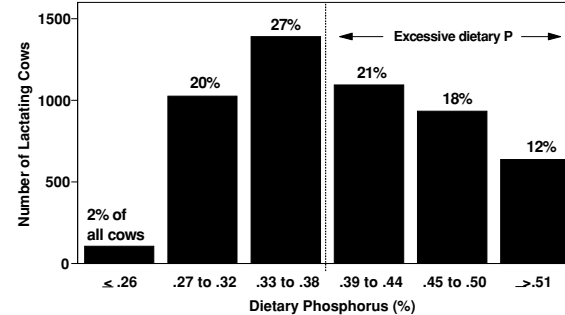
Whole-farm phosphorus management

To conform to nutrient management regulations, dairy farms that produce manure P in excess of crop P requirements will need to:

- Modify feed (and fertilizer) practices
- Seek additional land for manure application
- Increase exports of P (e.g. in manure, crops)
- Reduce livestock numbers on their farm

Impact of feed practices on P cycling

In Wisconsin, many dairy farms feed phosphorus well in excess of what is required for high milk production.



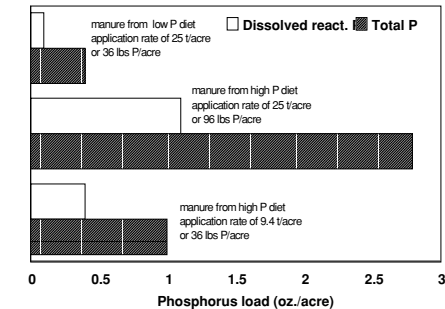
Excessive supplementation of dietary P results simply in a greater excretion of manure P. If the amount of manure applied to cropland is restricted to crop P removal, the supplementation of the dairy diet with P can increase dramatically the land required for recycling manure P.

Dietary P level	Land area needed to recycle manure P	Change in land area due to diet P supplementation
%	acre	%
.35	1.6	0
.38	1.8	13
.48	2.4	57
.55	2.9	87

For the many dairy farms that already have soils that test high or excessive in soil test P, feed management could very well be the most critical element of a farmer's ability to comply with manure management regulations.

- On Wisconsin dairy farms, lowering dietary P to recommended levels would reduce the number of farms having a positive P balance by 67%, and the amount of land in positive P balance (i.e. manure P exceeds crop P) by 60%.

The amount of diet P supplement fed to dairy cows influences the amount and form of P in runoff from manure-amended fields.



Conclusions

Perhaps the greatest improvement in P management on dairy farms would come from reductions in the importation of unnecessary inorganic fertilizer and diet supplements. The simple practice of aligning diet P levels to the cow P requirements could vastly improve a farm's P balance.

Other improvements in P management on dairy farms can be accrued by linking livestock numbers to the area of cropland available for manure utilization, and by manure processing that concentrates manure P thereby increasing the economic distance it can be transported.

Effective strategies aimed at improving nutrient use must be done in partnership with the feed and fertilizer consultants, veterinarians and manure haulers hired by farmers to make nutrient management decisions.

References

- Eberling, A.M., L.R. Bundy, J.M. Powell and T.W. Andraski. Dairy diet phosphorus effects on phosphorus losses in runoff from land-applied manure (in press).
- Jackson-Smith, D. and J.M.Powell (2000). How Wisconsin Dairy Farmers Feed Their Cows: Results of the 1999 Wisconsin Dairy Herd Feeding Study. Wisconsin Farm Research Summary No. 5. Program on Agricultural Technology Studies. University of Wisconsin, College of Agricultural and Life Sciences. 16pp.
- Powell, J.M., Z. Wu, and L.D. Satter. 2001. Dairy diet effects on phosphorus cycles of cropland. Journal of Soil and Water Conservation. 56 (1) 22-26.
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